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ORIGINAL RESEARCH

Residential aged care homes: Why do they call '000'? A study of the emergency prehospital care of older people living in residential aged care homes

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Abstract

Objective: To describe the clinical characteristics, medical interventions and patterns of ambulance service use related to the emergency, prehospital care of older people living in residential aged care (RAC) homes.
Methods: Retrospective cohort study using secondary analyses of routinely collected clinical and administrative data from Ambulance Victoria and population data from the Australian Bureau of Statistics for the state of Victoria, Australia. Participants included people aged 65 years and over, attended by emergency ambulances from 2008 to 2013, with data captured in the Ambulance Victoria electronic record.
Results: The mean (standard deviation) age of RAC residents attended by emergency ambulance was 85 (7.3) years and 63% were women. Common comorbidities included dementia (32.7%), ischaemic heart disease (27.7%) and osteoarthritis (24.6%). Polypharmacy was prevalent with 70% currently prescribed antibiotics, over 20% prescribed sedatives and a further 14.9% antipsychotics. Fifteen

percent of attendances were for falls, which were more frequent among women than men. Other common reasons for ambulance call-out included uncontrolled pain, respiratory tract infection, non-specific febrile illness and altered conscious state. Almost 90% of people were transported to hospital from the RAC, with just over half of call-outs occurring out-of-hours.
Conclusion: This is the first study to describe emergency prehospital care, case-mix and intervention of frail, older people living in RAC. These results demonstrate a clinically complex group of people with high rates of comorbidity, cognitive impairment and polypharmacy. These valuable data will inform education and training of prehospital clinicians, assist in targeting preventative medicine and primary care programmes and further development of alternate, acute and emergency care pathways for this unique patient group.

Key words: *emergency medicine, geriatric medicine, health system, prehospital care, public health, residential aged care home.*

Key findings

- People living in RAC homes who are attended by an emergency ambulance experience low incidence of prehospital intervention, yet high rates of transport to hospital.
- This population are clinically complex with frequent comorbidity and polypharmacy.

Introduction

Older people comprise a significant proportion of people requiring emergency medical care.[1] Within high-income countries, it has been demonstrated that older adults, often defined as people aged 65 years and over, contribute to an escalating demand in acute medical services and in particular emergency ambulance call-outs.[2]

A subgroup of older adults live in residential aged care (RAC) homes. Within EDs and hospitals, people living in RAC have been identified as unique in terms of clinical presentation, case-mix, admission rates, intervention and goals of care.[3] They frequently have multiple medical comorbidities, are frail and have cognitive impairment and other disabilities.[3,4]

In addition to direct presentations to hospital EDs, RAC residents frequently experience emergency prehospital care and transport to hospital via the ambulance service, accounting for one-fifth of all

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emergency ambulance call-outs to older people.[3,5] In Victoria, Australia, people living in RAC experience over 770 emergency ambulance call-outs per 1000 population per year, up to four times greater than older people living in the community.[6] Up to 95% of RAC residents seen in EDs are transported to hospital by emergency ambulances.[3–5]

Prehospital care is a vital part of the acute care pathway. It allows clinicians to assess and treat people at the scene, often earlier in their course of injury or illness. Currently, in most well-established emergency health systems, there are differences in the scope of practice and human and technical resources available in emergency ambulance services and hospital EDs. There may also be differences in patterns of injury and illness and clinical acuity between people seen by emergency ambulance clinicians and those seen in hospital, but these are under-documented.[3] Little is known about the characteristics and health of RAC residents assessed and treated by prehospital clinicians but discharged on scene or referred to other care providers and not transported to hospital.

Despite consistently high rates of emergency medical care, there is a paucity of evidence internationally regarding the prehospital medical care, case-mix and resource requirements for this unique group of older people.[3,7] Understanding of these clinical and administrative patterns is essential to inform improvements in the delivery of emergency medical care to frail and vulnerable older people, including alternate acute care pathways and targets for preventative healthcare.

The aims of the present study are to describe the clinical characteristics and medical interventions related to the emergency, prehospital care of older people living in RAC. As rates of emergency ambulance call-out and frequency and clinical presentation of some acute illness and injuries have been found to vary between men and women, there was a specific objective to establish

whether there were gender differences in rate of transport to hospital and case-mix.[2,6–9]

Methods

Design and setting

We conducted retrospective analysis of prospectively collected routine clinical and administrative data from Ambulance Victoria (AV) and the Australian Bureau of Statistics. AV is the primary provider of emergency ambulance services across rural, regional and metropolitan Victoria, Australia.

Victoria, Australia, has a population of approximately six million people, of which 839 000 are aged 65 years and over.[10] During the study period, there were up to 43 601 people living in RAC in Victoria per year accounting for approximately 5% of the total population aged 65 years and over.[6,11]

Study sample size was expanded to include all ambulance call-outs to people aged 65 years and older living in RAC in Victoria, Australia, during the period 1 January 2008 to 31 December 2013. This was to ensure inclusion of people from diverse geographical areas of the state and a timeframe broad enough to avoid skewing by epidemic illness such as flu and to ensure temporal consistency.

Data sources

De-identified data were provided by AV and included the parameters listed in Box 1. Case nature details the cause for the call-out such as mechanism of trauma, whereas the final paramedic assessment is documented at the end of the episode of care and details the primary acute complaint. These diagnoses made by prehospital clinicians are often preliminary and made without the

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BOX 1. *Data variables requested from Ambulance Victoria*

Demographic characteristics
- Age
- Sex
- Home postcode

Medical characteristics
- Past medical history
- Current medications

Reason for ambulance call-out and initial patient assessment
- Case nature
- Final paramedic assessment
- Initial heart rate, systolic blood pressure, respiratory rate, blood glucose level
- Initial electrocardiogram rhythm and respiratory state
- Initial pain score
- Paramedic intervention and administration of medication
- Patient outcome
- Transport indicator
- Not transported reason

Administrative case data
- Scene postcode
- Rural *versus* metropolitan location
- Time and date of call-out
- Highest dispatch code
- Scene and transport times
- Treating crew

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benefit of additional investigations. Data were derived from routine clinical electronic records and are reliant on manual entry by clinicians. Many fields include the use of drop-down boxes of predefined values and include an 'other' category.

Compiled past medical history was used to calculate an age-adjusted Charlson Comorbidity Score, which provides a measure of mortality risk and has been found to be a valid measure of short-term mortality in older people acutely admitted to hospital.[12,13]

Data linking the Index of Relative Socioeconomic Advantage and Disadvantage, (IRSAD) with RAC postcode was obtained from the Australian Bureau of Statistics.[14] IRSAD provides a summary measure of both social and economic advantage and disadvantage, from variables including mean income, education and employment within a defined geographic area.[15] Higher scores indicate greater features of advantage and fewer of disadvantage and vice versa.[15]

Data management and analysis

Data analyses were conducted using Stata version 14 (StataCorp, College Station, TX, USA). Descriptive analyses included mean and standard deviation (SD), frequencies and percentages. Continuous and categorical variables were compared using independent t-tests and χ^2 statistics.

Ethics

The study was approved by the Monash University Human Research Ethics Committee (CF14/2705–2 014 001 396) and AV Research Governance Committee (R14-012).

Results

Over the 5-year study period, there were 188 849 emergency ambulance call-outs to people aged 65 years and over living in RAC in Victoria, Australia.

Data quality

Data quality was limited by the use of 'other' categories; in particular during the recording of diagnosis and intervention. Numbers of missing values were small for most variables with the exception of initial vital signs, respiratory status, and electrocardiogram rhythm, where large numbers of missing values existed (Tables 1–5).

Demographics and medical characteristics

The mean (SD) age of patients was 85 (7.3) years with 7% of people aged 95 years and above. A greater proportion of the cohort were women (63%), and three-quarters lived in metropolitan regions. Almost 60% of call-outs were to people residing in geographic areas with higher IRSAD scores (Table 1).

This group had a high rate of medical comorbidity with an average of 5.4 medical diagnoses per patient (Table 2). Over one-third of the population had a documented history of dementia with other frequently reported comorbidities including ischaemic heart disease, osteoarthritis, diabetes and depression. When translated to an age-adjusted Charlson Comorbidity Index score, over 70% of residents scored five and above indicating a comorbidity profile with a high risk of mortality (Table 2).

Polypharmacy, the prescription of multiple medications for an individual, was common with residents reported to have an average of 7.9 different prescribed medications (Table 2). Over 70% of people were currently receiving antibiotics. In addition, prescription of potentially psychoactive and hypnotic agents was common with 25% of residents prescribed opioids, 24% prescribed sedatives (predominantly benzodiazepines), 20% receiving antidepressants and over 14% prescribed antipsychotics (Table 2). Women were more frequently prescribed opioids, sedatives and antidepressants, with antipsychotic agents more frequently prescribed in men.

Clinical case-mix and acuity

Fifteen percent of call-outs were for falls with most remaining ambulance attendances for acute medical complaints (Table 3). The final paramedic assessment was most frequently categorised as uncontrolled pain, superficial injury, suspected respiratory infection, shortness of breath, altered conscious state or febrile illness/presumed infection. Women were more commonly found to have pain, injury or fracture with dyspnoea and suspected respiratory tract infection more common in men (Table 3).

Most recorded vital signs were within normal limits with the exception of the Glasgow Coma Scale (GCS) score where 47% of people were recorded by paramedics as having a GCS score consistent with an altered conscious state. Initial pain scores were missing for 12% of cases (Table 4). The initial pain score was none to mild (0–3/10) in over 75% of people with 6.3% recorded as having moderate pain (3.1–6.9/10) and 5.8% as having severe pain (7–10/10). Initial readings of oxygen saturation, blood glucose, respiratory status and electrocardiogram findings were missing for over 40% of cases (Table 4).

Interventions and medications administered by paramedics

Overall, excluding the provision of advice or reassurance, half received a medical intervention. One-third of residents received supplemental oxygen, 23% received an intravenous cannula and 22% had cardiac monitoring (Table 5). Less than 1% of people were reported as receiving a resuscitative procedure such as airway management or cardiopulmonary resuscitation. Provision of prehospital medication or fluid was uncommon; intravenous fluids were administered in 8% of residents, intravenous opioids, morphine or fentanyl in 8% and 4% of people, respectively, and antiemetics in 4% (Table 5).

Emergency ambulance service usage

Ninety percent of residents were transported to hospital. Of those not transported, most (52%) were deemed not to require acute medical

TABLE 1. *Age, location, Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD), call time and outcome for RAC residents attended by emergency ambulances in Victoria, by gender from 2008 to 2013*

	Women (*n* = 120 807)	Men (*n* = 67 991)	All (*n* = 188 849)
Age groups (years) (%)			
65 to 69	2.7	5.8*	3.8
70 to 74	4.6	8.6	6.1
75 to 79	9.9	14.1	11.4
80 to 84	20.9	23.2	21.7
85 to 89	30.3	27.3	29.2
90 to 94	22.4	16.1	20.1
95 to 99	8.1	4.4	6.8
100+	1.1	0.5	0.9
Location† (%)			
Metropolitan	75.1	73.9*	74.6
Rural	24.9	26.1	25.4
IRSAD† (%)			
Lowest 50	38.9	42.9*	40.3
Highest 50	61.1	57.1	59.7
Outcome – transported to hospital (%)			
Yes	89.6	89.8‡	89.7
No	10.4	10.2	10.3
Highest dispatch code† (%)			
1 (time critical)	34.4	34.8*	34.6
2 (urgent)	46.0	43.7	45.1
3 (non-urgent)	18.1	19.4	18.6
4	1.5	2.1	1.7
Transporting team (%)			
ALS paramedics	96.5	96.1*	96.4
Mobile Intensive Care Ambulance paramedics	3.5	3.9	3.6

*P < 0.001. †Missing data for gender, location, IRSAD and dispatch code were 51 cases (0.03%), 519 cases (0.3%), 577 cases (0.31%) and 131 cases (0.07%), respectively. ‡Not significant.

care and 14% were referred to community care providers (Table 1).

One-third of call-outs were attended with the highest dispatch code, requiring the most rapid response. This was more common for acute medical conditions than for falls. Less than 4% of call-outs were attended by paramedics with extended skills (Table 1).

Ambulance call-outs were evenly distributed by day of the week, including weekends. Frequency of call-outs increased during the day with a peak from 9 am to 11 am,

and extending to 9 pm. Fifty-eight percent of call-outs occurred outside of normal business hours (08.00 to 18.00, Monday to Friday) (Table 1, Fig. S1).

Discussion

The present study is the first to provide a descriptive overview of the emergency prehospital medical casemix and intervention of older people living in RAC across both a metropolitan and rural setting. Key findings include a high rate of

polypharmacy and antibiotic prescription and frequent transport to hospital but a low rate of prehospital intervention.

Consistent with studies from inhospital settings, this group were clinically complex at baseline with frequent comorbidity and medication prescription.[3,7,16] Over one-third had a documented history of cognitive impairment, with other common co-morbidities including ischaemic heart disease, stroke and chronic lung disease. It may be surmised that this incidence of

TABLE 2. *Recorded past medical history, age-adjusted Charlson Comorbidity Index and recorded current medications of RAC residents attended by emergency ambulances in Victoria from 2008 to 2013*

	All (*n* = 188 849)
Past medical history – recorded medical diagnoses (%)	
Hypertension	47.3
Dementia	32.7
Ischaemic heart disease	27.7
Osteoarthritis	24.6
Diabetes	20.9
Depression	19.1
Cerebrovascular disease	18.4
Chronic obstructive pulmonary disease	18.3
Atrial fibrillation	17.0
Cardiac failure	16.8
Osteoporosis	13.2
Cancer	11.6
Other genitourinary disorder	11.2
Falls	8.5
Fracture	8.2
Anxiety	7.6
Chronic renal impairment	6.3
Chronic pain	5.4
Age-adjusted Charlson Comorbidity Score (%)	
Low (0 to 1)	0
Medium (2 to 4)	25.9
High (5+)	74.1
Number of recorded medications, mean (SD)	7.9 (0.01)
Recorded medications (%)	
Antibiotics	73.8
Cardiovascular (antihypertensives and antiarrhythmics)	47.9
Diuretics	31.4
Opioid	25.2
Sedative other	24.3
Antidepressants	20.4
Antipsychotics	14.9
Antiplatelets	7.1
Anticoagulants	6.9
Oral hypoglycaemic agents	4.1
Insulin	3.8
Nil current medications recorded	0.7

SD, standard deviation.

comorbidity will contribute to increased frequency of acute illness, greater complexity of clinical assessment and treatment and potentially altered goals of clinical care. This suggests the need for specialised training of both primary and emergency response clinicians, specific protocols targeting older people and development and of alternative pathways of acute care that may negate the need for an emergency hospital transfer.

There were gender differences in frequency of past medical illness in particular musculoskeletal complaints and heart disease and in final paramedic diagnosis with pain, falls and fractures more frequent in women and respiratory complaints more common in men.

People living in RAC have been identified as being at risk of potentially inappropriate prescribing.[7,17] One of the key findings from the present study was the high rate of polypharmacy; notably the use of sedatives, anti-psychotic and antidepressant agents, which are frequently used for the control of behavioural symptoms or as a form of chemical restraint. Among other consequences, frequent prescription of these agents may contribute to acute delirium, adverse drug reactions and increased risk of falls, which frequently lead to ambulance call-out.[18]

Additionally, the prevalence of antibiotic prescription was very high. A proportion of these may be due to acute infectious illness, which precipitated the ambulance call-out; however, previous reports have concluded significant the rates of inappropriate antibiotic prescribing in RAC.[19] These prescriptions may be due to complexity of clinical assessment and atypical clinical signs (such as delirium) leading to presumption of infection without adequate diagnosis, enhanced difficulty in obtaining investigations such as chest X-ray radiographs and pressures from family members or other clinical staff to provide medical treatment for an otherwise undefined change in physical or behavioural state. For individuals, overuse of these medications may

TABLE 3.   *Recorded reason for call-out and final paramedic assessment for RAC residents attended by emergency ambulances in Victoria by gender from 2008 to 2013*

	Women (*n* = 120 807)	Men (*n* = 67 991)	All (*n* = 188 849)
Reason for call-out† (%)			
Medical	71.0	76.9*	73.1
Fall	17.2	12.7	15.6
Other	11.8	10.4	11.3
Final paramedic assessment diagnosis† (%)			
Pain	15.0	12.0*	13.9
Superficial injury	9.8	9.0	9.5
Other	8.9	9.4	9.1
Other gastrointestinal complaint	7.8	8.2	7.8
Lower respiratory tract infection	6.1	8.5	6.9
Fracture	6.8	3.5	5.6
Altered conscious state	5.1	5.5	5.3
Shortness of breath	4.3	5.1	4.5
Febrile illness	3.7	5.1	4.2
No problem identified	4.0	3.9	4.0
Dizziness/unsteadiness/collapse	4.0	3.6	3.8
Stroke/transient ischaemic attack	4.0	3.3	3.7
Other cardiovascular complaint	2.8	2.4	2.7
Acute coronary syndrome	2.2	2.1	2.2
Congestive cardiac failure	2.3	1.9	2.1
Other genitourinary complaint	0.9	4.3	2.1
Cardiac arrhythmia	2.2	1.7	2.0
Urinary tract infection	1.9	1.8	1.9
Other respiratory complaint	1.4	2.0	1.7
Other neurological complaint	1.4	1.6	1.5
Head injury	1.2	0.8	1.1
Epistaxis	0.9	0.9	0.9
Other psychiatric complaint	0.6	0.9	0.7
Deceased	0.6	0.8	0.7
Other endocrinological complaint	0.7	0.7	0.7
Anxiety	0.8	0.5	0.7
Cardiorespiratory arrest	0.4	0.6	0.4
Other rheumatological complaint	0.3	0.3	0.3

*P < 0.001. †Missing data for reason for call-out and final paramedic assessment diagnosis were 9147 (4.84%) and 9882 (5.23%), respectively.

increase the risk of medication-related adverse event and heighten individual risk of resistant infection, which often adds complexity to the provision of medical and nursing care as well as exacerbating severity and prolonging duration of illness.[20] More broadly, for the health system, frequent use of these agents may contribute to the growing concerns of antimicrobial resistance and the resultant public health and economic consequences, which include increased use of acute medical resources.[20,21]

TABLE 4. *Recorded initial vital signs, cardiac rhythm, respiratory status and pain score for RAC residents attended by emergency ambulances in Victoria from 2008 to 2013*

	All (*n* = 188 849)
Initial heart rate (bpm)†, mean (SD)	84.9 (19.9)
Initial systolic blood pressure (mmhg)†, mean (SD)	135.2 (30.7)
Initial respiratory rate (bpm)†, mean (SD)	19.6 (7.1)
Initial Glasgow Coma Scale score†, median (IQR)	15 (14–15)
Initial oxygen saturation†, median (IQR)	96 (94–98)
Initial blood glucose level (mmol/L)†, mean (SD)	8.5 (4.0)
Initial respiratory status† (%)	
Normal respiratory status	29.3
Apnoeic/decreased respiration	0.5
Respiratory distress	13.0
Assisted ventilation	0.1
Missing	57.1
Initial cardiac rhythm† (%)	
Normal sinus rhythm	31.6
Cardiac arrest	0.80
Atrial fibrillation/flutter	14.4
Other tachycardia	7.6
Other	6.6
Missing	39.0
Pain score† (%)	
Zero	63.9
Mild (1 to 3)	11.7
Moderate (3.1 to 6.9)	6.3
Severe (7 to 10)	5.8
Missing	12.3

†Missing data for initial heart rate, systolic blood pressure, respiratory rate, Glasgow Coma Scale, oxygen saturation, blood glucose level, pain score, initial respiratory status and initial cardiac rhythm were 13 267 (7.0%), 14 698 (7.8%), 11 469 (6.1%), 10 893 (5.8%), 120 357 (63.7%), 132 112 (70.0%), 23 182 (12.3%), 107 765 (57.1%) and 73 720 (39.0%), respectively. IQR, interquartile range; SD, standard deviation.

Among this patient group, the most common reasons for ambulance attendance included a fall with or without related injury, shortness of breath and respiratory tract infection, other suspected infection/febrile illness, pain and altered conscious state. These findings complement those from studies conducted in hospital settings and reinforce the observation of this patient group as unique.[3,4] RAC residents are distinct from older people living in the community who present more commonly with cardiovascular complaints and less commonly for falls and associated injury.[3,4] Ambulance attendance for falls may be necessary if the fall results in significant injury or occurs as a result of physical decline from a co-existent acute illness. Some falls may also be preventable with programmes such as minimisation of prescription of sedative medications, exercise programmes and attention to environmental settings and features.[22] However, the decision to call an ambulance may also be influenced by non-patient factors such as the ability of RAC staff to assess and treat injury, by accessibility of primary care teams to review patients and by financial or medicolegal concerns of staff or facility leadership groups, where the responsibility for patient care is rapidly and potentially inappropriately shifted to the readily accessible emergency care providers.[23]

The high number of residents reported to have impaired conscious state on initial assessment by ambulance clinicians warrants discussion, as this feature adds complexity to clinical assessment, diagnosis and management, as noted in ED studies.[3,4,24] An altered conscious state, as measured here by the GCS, may relate to the acute event such as head injury or delirium complicating an acute illness or may reflect a baseline reduction in cognitive ability such as dementia. An accurate estimation of GCS may also be complicated by hearing impairment or for non-native language speakers. In the current system of acute care, it may be difficult for clinicians to differentiate acute from chronic reduction in cognition, which may add complexity to identification of other symptoms and signs of injury and illness and impact decision-making surrounding additional interventions and investigations. Previous studies have suggested that a great proportion of elderly people presenting to emergency medical services will have an atypical presentation of disease.[25,26] It has been estimated that over 50% of people aged 80 years and above presenting to the ED may have an uncharacteristic clinical presentation and up to 15% may not describe any symptoms of the underlying acute disease.[26] These atypical presentations add complexity to patient assessment and may lead to inappropriate or delayed clinical intervention and disposition decisions. These features may be heightened in an emergency response setting where clinical

TABLE 5. *Recorded medications given and medical interventions made by paramedics attending RAC residents in Victoria from 2008 to 2013*

	All (n = 188 849)
Medical intervention (%)	
Advice and reassurance	77.9
Supplemental oxygen	36.5
Intravenous cannula	23.1
Cardiac monitoring	22.2
Repositioning	9.9
Spinal immobilisation	5.7
Bandage or dressing	4.0
Sling/splint/ice	4.0
Pulse oximetry	2.6
Airway manoeuvres and/or adjuvant device	2.1
Cardiopulmonary resuscitation	0.5
Bag valve mask ventilation	0.4
Endotracheal intubation	0.3
Non-invasive ventilation	0.3
Defibrillation	0.2
Pelvic binder	0.2
Medication administration (%)	
Intravenous fluids (crystalloids)	7.9
Morphine	7.2
Methoxyflurane	7.0
Glyceryl trinitrate	5.6
Aspirin	5.1
Fentanyl	3.8
Salbutamol or ipratropium bromide (inhaled)	3.5
Antiemetic	3.4
Frusemide	0.7
Glucose	0.8
Adrenaline (intravenous or intraosseous)	0.4
Benzodiazepines	0.4
Paracetamol	0.01
Medication administration by paramedic (%)	24.2
Advanced medical intervention by paramedic (all interventions excluding advice or reassurance only) (%)	50.2

assessment and management are frequently made with limited time and investigative resources. This effect may be mitigated with improved training and education of clinicians, enhanced communication between primary care and emergency care teams and provision of alternative acute care pathways with specialised clinical response.

Additionally, it is likely these factors confound the assessment and management of pain.[27] Pain is common among people living in RAC and there is concern that this symptom is both under recognised and under treated.[28] In emergency care, in both a prehospital and hospital setting, pain is frequently measured with a simple numeric scale. However, in these circumstances there are both patient factors such as delirium or chronic cognitive deficits and environmental factors such as background noise and clinician workload that may negatively influence the accuracy of these measures.[29,30] Results of the present study show over 80% of residents were assessed as having mild or no pain (<3/10), yet it is possible this underrepresents the true incidence of acute pain and discomfort in this population. In this population and in particular for those patients with cognitive impairment, these protocols should be expanded to mandate additional training in and use of multi-dimensional pain assessment methods, which may include observational tools, additional self-report tools and care-giver reporting.[30]

In contrast to in-hospital settings, we observed a low rate of prehospital medical intervention with only 25% of people receiving fluid or medication and only 50% receiving an intervention other than reassurance or advice. This differs from studies conducted in inpatient and ED cohorts, which frequently describe high rate of intervention, investigation and medication administration.[3,5] The observed low rate of intervention associated with high patient complexity and frequent need for transport to hospital appears paradoxical. From the data provided, it is not clear if these interventions are delayed and subsequently occur within hospital, if the need for intervention is under-recognised because of atypical presentations or heightened patient complexity, or if the required intervention is not available to clinicians working in strictly protocol driven practice. Alternatively, these findings may also reflect call-outs for non-urgent conditions where nil intervention is required yet the lack of an alternative results in the use of an emergency ambulance. Further, likely prospective studies

are needed to adequately investigate these alternatives.

Strengths and limitations

This was a retrospective epidemiological study, encompassing an entire state of Australia including metropolitan, regional and rural areas over a period of 5 years. There is a single service provider for emergency ambulances across the state and thus all presentations during this time period were captured within the data.

Further analysis of clinical acuity was limited by missing data for many of the vital signs. No data were provided on medication dosing or duration, functional abilities and frailty. Additionally, there were no data on severity of current medical diagnoses, degree of associated disability or chronic symptomatology. Values are manually inputted by clinicians at time of patient care and are therefore subject to clinical biases and time pressures that may influence accuracy of inputs. Some of these factors could be improved in future with direct transmission of values from monitors to electronic records. Use of the 'other' category may be minimised in future with optimisation of drop-down lists for completion of variables. Additionally, some routine measures such as a numerical rating scale to detect pain and use of the GCS score to reflect conscious state may not provide a true reflection of these parameters in this patient population.

Conclusion

Overall these findings provide an important clinical picture of prehospital case-mix for this vulnerable group, frequently encountered in prehospital care. This is useful in guiding clinician training and protocol development as well as highlighting key concerns such as polypharmacy, suspected infection, pain and confusion that may become foci for both preventative and early intervention programmes. These should also inform primary care service groups, such as general practitioners in encouraging them to

adapting their training, clinical care and service provision to the needs of this unique patient group. In addition to the clinical descriptors above, the low rates of common prehospital medical interventions and the consistent patterns of call-outs both within and out-side of usual business hours provide valuable data to inform development of alternate, specific, acute and emergency care pathways for this people. This may include hospital outreach emergency care clinicians, upskilling of some paramedics to extend skills and creation of multidisciplinary prehospital care teams, mobile radiology and pathology services and telemedicine support for RAC staff. Additionally, those programmes currently in use such as Hospital-in-the-Nursing Home must be appropriately evaluated as to their impact on emergency ambulance call-outs to allow for appropriate adaption or expansion of these services. Further studies are needed to investigate key contributing factors not captured in this data that influence the frequency and need for emergency ambulance services in this population. This includes clinical features such as frailty and functional ability, role of advance care plans and influence of community healthcare teams, specialist clinicians, residential care home resources and staffing and hospital outpatient and outreach services.

Competing interests

None declared.

Data availability statement

The data that support the findings of this study are available from Ambulance Victoria. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the authors with the permission of Ambulance Victoria.

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Supporting information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Figure S1. Time of day and day of week of ambulance call-out for RAC residents attended by emergency ambulances in Victoria, by gender from 2008 to 2013.